

NOTES ON SALICYLIC ACID.

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SALICYLIC ACID is a drug of recent introduction, which has been much written upon in all the journals. Having read a short paper on it in *L'Union Médicale*, I purchased a quantity of the drug in the beginning of this year, and carried out several experiments, some of which are very interesting. I propose to look at the subject from a threefold point of view. Having given a rapid sketch of its pharmacy, which is very interesting, I will then narrate some of the experiments, and try to explain some of its uses from its physiological actions.

Salicylic acid occurs, when pure, in the form of a pure white powder, slightly soluble in water, soluble in alcohol and in warm glycerine. It has no smell, but when in solution its odour resembles that of carbolic acid. Its taste is slightly sweet. Its chemical formula is $C_7 H_6 O_3$. The scope of this paper prevents my going into its preparation; suffice it to say that it is found in nature in the essential oil of the meadow sweet (*Spiraea ulmaria*), and in the oil of winter green (*Gaultheria procumbens*). Its relations, on the one hand to carbolic acid, and on the other to gallic acid, are very instructive, as its properties are antiseptic and astringent. The formulæ of the three substances are as follows:—

$C_6 H_6 O$ carbolic acid;
 $C_7 H_6 O_3$ salicylic acid;
 $C_7 H_6 O_5$ gallic acid.

It is thus not only intermediate in composition, but also inherits the properties of both its neighbours. On heating salicylic acid, it splits into carbolic and carbonic acids, the smell of the former being easily detected.

Its insolubility in water is a great disadvantage in salicylic acid, as the antiseptic lotions of it cannot easily be prepared. Dr Bosc, of Berlin, has discovered that, with the aid of borax, as much as ten parts of the acid can be dissolved in one hundred of water. Now, in water, salicylic acid is only soluble to the extent of one in three hundred, so that this is a great advantage over the simple solution in water. Dr Bosc has pointed out that, as neither borax nor salicylic acid is chemically pure, a small amount of residue must always remain. However, I have been able to dissolve as much as twenty grains of salicylic acid in one ounce of water, in which fourteen grains of "lump borax" had previously been dissolved by the aid of heat. Dr Bosc used "powdered borax," which is very apt to be adulterated, and this accounts for the residue obtained by him. My solutions, made with the borax in lump, had no residue whatever. The test for salicylic acid is very distinctive; with perchloride of iron, a beautiful dark purple solution, not unlike Condry's fluid in appearance. I have found out, since reading my paper at the Royal Medical Society, that this solution, in the presence of organic impurity in water, acts in precisely a similar manner to liquor potassæ permanganatis, the fine colour being entirely lost, or changed to black or brown, in the presence of these impurities.

It is not within the scope of this paper to enlarge upon the preparations of this drug, but I may merely mention how it may conveniently be given internally, as it is found by some practitioners to be rather troublesome to administer. In powder, it is almost impossible to swallow it alone, as I believe, from the experience that I had in trying it, that the heat of the mouth causes carbolic and carbonic acids to be evolved. It can be administered in rice paper, or in combination with starch, or it may be administered in the following formula, which I have found useful, and which does not hurt the mouth and throat to any extent compared to the powder:—

R Acidi salicylici,
Potass. bicarb. āā gr. xv.
Aquæ ži. S.

Carbonic acid is evolved, and the potash combines with the acid to form salicylate of potash. Salicylic acid is non-poisonous, as much as ðiv. having been administered in Germany. I myself have taken as much as ðii. without producing the slightest bad effect, except displaying its specific action, which I shall afterwards explain.

Actions of Salicylic Acid.—It is antiseptic, disinfectant, deodorizer, and astringent.

The following experiments, classified, may be of use in proving the points which I think are important:—

1st. *Experiments as to the Action of Salicylic Acid taken Internally.*

2d. *Experiments as to its Action on Fermentable Fluids.*

3d. *Experiments as to its Action Externally Administered.*

1st. *Action Internally.*—(1) At 3 P.M. on 9th January 1876, I took a dose of nine grains of the powder of salicylic acid. On swallowing it, I experienced a most disagreeable sensation of choking, from the astringent nature of the drug, and also from what seemed to be an evolution of carbonic acid gas. I took this dose on an entirely empty stomach, not having tasted food since 8 A.M. At 5 P.M., before dining, I passed a quantity of urine, which I examined with the liq. ferr. perchl., and it gave the dark purple reaction distinctly. I failed to detect it in the saliva. I put aside a small phial containing some of the urine then passed. Late that same evening, about an inch of deposit made its appearance in the bottom of the bottle, but the supernatant fluid was clear, and quite fresh to the smell. It remained so till the 18th January, when an ammoniacal odour began to develop. It thus was kept fresh for four nights. After swallowing this dose, my mouth and throat were dry for a long time, and then a regular catarrh of the mucous membranes of nose, mouth, and throat came on, and lasted for some days. This action I observed on every occasion on which I took this drug internally.

(2) 17th January.—I took three drachms of a solution of one of salicylic acid in three hundred of water at 12.10 P.M., and at the same time also injected one and a half drachms of the same solution per rectum. In twenty minutes, it was detected in the urine.

(3) 24th January.—I took, at 10 P.M., a dose of infusion of two drachms of jaborandi leaves, and at 10.40 injected, per rectum, a nine-grain solution of salicylic acid with borax. Although, at 12 P.M., it was distinctly traceable in the urine, it could not be detected in the saliva. The salivation from the jaborandi was most complete, lasting for six hours, and I calculated that twelve ounces of saliva were poured out. We are told by experimenters that cases of belladonna poisoning have been cured by giving large doses of jaborandi, and eliminating the poison by the salivary glands. However, with salicylic acid, I could not detect it in this hyper-secretion of fluid.

(4) On injecting a pretty strong solution of the acid per rectum, I found that the catarrh, which is set up by the administration of the drug by the mouth, is also produced in this way.

(5) Wishing to see the action of a large dose, I took, one evening, a dose of ℥ii. of the drug, part by mouth, and partly per rectum. The temperature and pulse were not influenced by it, nor was there any gastric disturbance, which some writers insist takes place. However, the catarrh in the throat, mouth, and nose, which I had previously mentioned, all appeared, and besides this, my breath had the characteristic odour of the solutions of salicylic acid for some few days after taking the dose. I also

observed that my bowels were very much constipated for some three or four days.

2d. *Its Action on Fermentable Fluids.* a. *Urine.* b. *Milk.*

a. *Urine.*—(1) On 10th January, I took two one-ounce bottles, and, having filled both with perfectly fresh urine, added to the one a pinch of the salicylic acid in powder, and to the other nothing. The bottles were placed side by side, under precisely similar conditions, and freely exposed to the air. On the 12th January, two days after, the urine to which the powder had been added was perfectly clear and free from ammoniacal odour, while the other sample, left to itself, was muddy, and had a slight ammoniacal odour. On microscopic examination on the 14th, the first-mentioned sample was seen to contain no vibrios nor bacteria, while the second was teeming with these organisms. The urine passed, after taking a dose of nine grains, kept fresh, although exposed to the air, for four nights, as previously mentioned.

(2) 21st January.—I put aside two samples of urine, one containing two drachms of the 1-100 solution of salicylic acid, made by the aid of borax and heat, and called, for shortness, boro-salicylic solution, and the other sample left alone. The two samples were placed under precisely similar conditions, exposed freely to the air. On the 25th, the first specimen is perfectly clear and odourless, while the other is entirely cloudy, and has a strong ammoniacal odour.

(3) 25th January.—To a sample of putrid urine, I added one grain of salicylic acid in powder. The urine had a strong ammoniacal odour, but on the addition of the powder it became like the smell of fresh urine.

(b) *Milk.*—(1) 14th January.—I placed two ounces of sweet milk in a tumbler, and added to it two drachms of the 1-300 solution of salicylic acid in water. The tumbler was allowed to stand on a chimneypiece above a fireplace, in which the fire was lighted from eight in the morning till twelve at night. It was, therefore, in a position where every chance for fermentation to take place was present. Notwithstanding this, it remained free from the smell indicative of the lactic acid fermentation until the 18th, thus keeping fresh for four days.

(2) On adding a pinch of the powder to this putrid milk, the odour, which was very obnoxious, at once disappeared, and it assumed the smell of new milk, as formerly. With a strong solution, there is no doubt that milk might be preserved for considerable periods, as on the Continent butcher-meat has been kept sweet by rubbing the powder of salicylic acid into it.

3d. *Experiments as to its External Action.*—Having made some incisions with a bistoury in the back of my forearm, they bled severely. The application of the powder of salicylic acid was sufficient to arrest it. In paring a corn on the little toe, a con-

siderable amount of hæmorrhage usually takes place, which I never can stanch by pressure and cold. On this occasion, the application of the powder arrested it at once.

Conclusions arrived at from the above Experiments.—The conclusions arrived at from the above experiments are, that it is an antiseptic, deodorizer, and astringent, possessing these three properties in a marked manner. That it produces a specific action on the mucous membrane of the mouth, nose, and throat, is undoubted, as the catarrhal symptoms are produced in these regions whether it is taken by the mouth or rectum. That, from its rapid absorption by the blood, it is quickly carried through all parts of the economy, and its action is thus quickly manifested. The antiseptic properties being so marked, and its character being non-poisonous, it is sure to prove efficient in zymotic disease, in the same way that sulpho-carbolate of soda has been used.

Salicylic acid, although proved by Godeffroy to be three times as strong an antiseptic as carbolic acid, is so difficult to dissolve, that its spray is not efficacious. Its use as an external antiseptic is thus much prevented, as, from its non-irritating, and non-poisonous qualities, it is otherwise eminently suited for use externally. As it is not likely to rise into much fame as an external antiseptic, I shall conclude with a few remarks as to how its action may be explained in three diseases in which it has been used with success, viz., rheumatic fever, typhoid fever, and diphtheria.

No explanation of the changes which salicylic acid undergoes in the economy has yet been attempted, as far as I have observed in the journals. Is it not probable, as I mentioned previously, that salicylic acid, from the heat to which it is exposed in the alimentary canal, splits into carbolic and carbonic acids; that the carbonic acid, escaping as it passes down, causes the sensation of choking; and that the carbolic acid, coming in contact with gastric juice, forms an innocuous compound with some of its salts, and thus carries out its actions? This is the chemical explanation of its action, at least. By using the prescription before-mentioned, combining the potash and salicylic acid, we get rid of the carbonic acid gas, and thus prevent much of the burning in the throat.

Rheumatic Fever.—No doubt is expressed among practitioners as to the beneficial action of this drug in rheumatic fever. It has been tested largely in both hospitals and private practice, and found not only to shorten the disease, but also to lower temperature and relieve pain. Cases treated with continuous small doses are soon better. Its action in this disease is antipyretic. Possessing many of the properties of quinine, in the form of salicine, the temperature is lowered in much the same way as a large dose of quinine would do.

Typhoid Fever.—In this disease, salicylic acid has been little used in this country, but from German sources we have reliable

information regarding its application. Dr Reiss, of Berlin, used as large a dose as four scruples. He found that often after the first dose, and usually after the second, the temperature fell below the normal, and remained so for twenty-four hours. In these cases, only one daily dose of the under-mentioned formula was given, and it was found that eight or ten doses were sufficient. The formula for a dose was as follows:—

℞ Acid. salicyl.,
Sodæ carb. āā ðiv.
Tinct. aurant. ʒi.
Aquæ ʒiss. M.

The result was that, generally after the fourteenth day of the fever, there was no abnormal rise of temperature. Dr Reiss found that this result happened in the most of 260 cases which he treated.

The action in typhoid fever may be explained thus:—It acts in such enormous doses as an excellent astringent on the bowels, and also as an antiseptic on the system generally, as well as on the bowels.

Diphtheria.—Wagner used it as a remedial agent in diphtheria, and also in an epidemic of it, with success. Fronthcim also used it as a prophylactic in this disease, and it seems to me that it will be yet much used as a prophylactic in all febrile disease. My theory of its action in diphtheria is this, that it acts on the body generally as an antipyretic, and that, by setting up its specific catarrhal action on the mucous membranes of the throat, it helps to arrest the disease.

In the *Edinburgh Medical Journal*, 1837, Dr Blom ascribes the beneficial action of salicine to the fact that it acts as a tonic to the mucous membranes, and improves the character of the secretions. If this is the case, it may account in some manner for the action of salicylic acid in typhoid fever and diphtheria. Salicine is not so burning a substance to swallow as the salicylic acid, and it does not set up the characteristic catarrh which I mentioned.

I have now got through my subject, although there are many points of interest in the original on which I might have dwelt with profit. But I have already far exceeded moderation, and must draw to a close. The subject is an interesting one, and one is apt to go on *ad libitum*, at a congenial theme. I have only to state, in conclusion, that I have been as careful as possible to avoid mistakes in observation, and have been watchful not to overstate the results obtained.

